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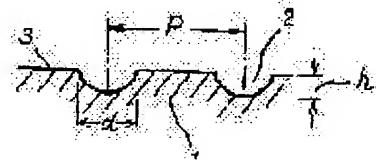
(54) COLD ROLLED SHEET

(57)Abstract:

PURPOSE: To manufacture a cold rolled sheet having both workability in pressing and high image clarity after coating by making a steel sheet into a cold rolled sheet provided with respectively different specified roughnesses on the surface and back faces by providing different roughnesses on a pair of upper and lower work rolls for rolling and executing skin pass rolling.

CONSTITUTION: The cold rolled sheet on which different roughnesses are respectively provided on the surface and back faces of steel sheet 1 is made by giving different roughnesses to a pair of upper and lower work rolls for rolling and executing skin pass rolling.)

Regular projecting and recessed parts whose diameters (d) are 50-200 μ m, depth (h) of concave parts is 2-16 μ m center distance between adjacent concave parts is 0.5-2.5 μ m are provided on the surface of one side. Random ruggedness of mean roughness Ra of 0.6-1.1 μ m is provided on the surface on the other side. In this way, the manufacture of the cold rolled sheet having both workability in pressing and high image clarity is enabled, workability in pressing of the steel sheet for automobiles is excellent and the quality problem of crack or the like is completely solved.



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ABSTRACT:

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CLAIMS

[Claim(s)]

[Claim 1] In the cold-rolled plate which prepared roughness different, respectively in the steel plate table rear face by giving and carrying out temper rolling of the roughness which is different in the work roll for rolling of 1 set of upper and lower sides The cold rolling plate characterized by for the diameter d having prepared the regular irregularity whose crevice pitch P which 50-200 micrometers and 2-16 micrometers crevice depth h adjoin is 0.5-2.5 micrometers in one field, and preparing the random irregularity whose average-of-roughness-height Ra is 0.6-1.1 micrometers in the field of another side.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Industrial Application] this invention relates to the cold rolling plate with which the ambivalence ability which, on the other hand, boils the image clarity after painting outside, and has press workability differs.

[0002]

[Description of the Prior Art] Conventionally, the cold rolled steel plate for processing carries out dull finish of the steel plate front face, in order to make press working of sheet metal easy to carry out. That is, it is because the operation which the lubricating oil for processing is stored by the irregularity formed in the steel plate front face at the time of press working of sheet metal, and lessens wear of metal mold and a steel plate, and prevents printing is carried out. Moreover, although research on press moldability is done from both sides of a molding technique the griddle side which is a material, the demand characteristics over a steel plate are upgrading and diversifying it more with highly-precise-izing and complication of a product. For this reason, the work roll which carried out dull processing of the steel plate roughness by shot blasting, discharge, or laser in the temper rolling finally adjusted as the present condition is used, and granularity is imprinted on the steel plate front face.

[0003] Moreover, although sheathing steel plates, such as the automobile body and home electronics, carry out paint finishing and a fine sight is given, to excel in the so-called image clarity [say / making it not spoil a fine sight by the scattered reflection of a painted surface in this case] is demanded. By making [many] the rate of improving the surface roughness profile of a steel plate, lessening paint surface irregularity after paint, and occupying for a horizontal level there, improvement in the regular reflectance of light and distortion of a map are lessened, and JP,3-38923,B is known as a steel plate which may raise the image clarity after paint conventionally. Moreover, while the amplitude of a crest and a trough becomes large, therefore the irregularity of a painted surface becomes intense, producing the scattered reflection of light and spoiling glossiness, non-** of a map is invited, the fall of image clarity is caused, and image clarity is made to deteriorate, so that center line surface roughness Ra is large, although it is the steel plate for paint more marked than before which may be raised about image clarity like JP,3-39761,B.

[0004]

[Problem(s) to be Solved by the Invention] As mentioned above, while lessening improvement in the regular reflectance of light, and distortion of a map and raising the image clarity after paint by making [many] the rate of lessening paint surface irregularity after paint and occupying for a horizontal level, press workability worsens. Moreover, if center line surface roughness Ra is enlarged in order to raise press workability on the other hand, while the amplitude of a crest and a trough will become large, therefore the irregularity of a painted surface will become intense, producing the scattered reflection of light and spoiling gloss, distortion of a map is caused and the fall of image clarity is caused, and it will deteriorate and will be said for the double-sided repulsion of the image clarity that it carries out.

Therefore, it is the purpose of this invention for this invention to realize enhancement of image clarity

and an improvement of press workability compatible, and to aim at advantageous solution about an improvement of image clarity and press workability.

[0005]

[Means for Solving the Problem] This invention solves the above problems, enhancement and the other sides of image clarity aim at an improvement of press workability, and one side has them in the both ***** cold rolling plate of image clarity and press workability. In the cold-rolled plate which prepared roughness different, respectively in the steel plate table rear face when the place made into the summary of the invention gives and carried out temper rolling of the roughness which is different in the work roll for rolling of 1 set of upper and lower sides It is in the cold rolling plate characterized by for the diameter d having prepared the regular irregularity whose crevice pitch P which 50-200 micrometers and 2-16 micrometers crevice depth h adjoin is 0.5-2.5 micrometers in one field, and preparing the random irregularity whose average-of-roughness-height Ra is 0.6-1.1 micrometers in the field of another side.

[0006]

[Function] This invention is explained to a detail according to a drawing below. Drawing 1 is the explanatory view showing the profile which forms the split face of the front face of the steel plate concerning this invention. As shown in drawing 1, the average diameter d of the rim of the trough 2 of the front face of a steel plate 1 describes the condition range of having prepared the regular irregularity whose crevice pitch P which 2-16 micrometers crevice depth h from 50-200 micrometers and the middle flat part 3 adjoins is 0.5-2.5 micrometers. First, in the case of less than 50 micrometers, the metallic contact part depended insufficiently [supply / on a steel plate heights front face / lubricating oil] occurs, a diameter d has bad press workability, and it becomes easy to generate a crack etc. Moreover, although press workability is good when it exceeds 200 micrometers, since irregularity does not disappear in the front face after paint, image clarity falls.

[0007] Next, it is for a crevice to be crushed in a crevice depth of less than 2 micrometers by the planar pressure under shaping, and to be unable to secure lubricant, but, as for the reason for having set crevice depth h from a middle flat part to 2-16 micrometers, for frictional resistance to increase, and since irregularity will not disappear on a front face if it exceeds 16 micrometers, image clarity falls.

Furthermore, if the reason for having prepared the regular irregularity whose adjoining crevice pitch P is 0.5-2.5 micrometers is less than 0.5 micrometers A projection arises by the lap of a crevice, can take a height during press working of sheet metal, and generating of iron powder increases. It is because press workability is spoiled, if it exceeds 2.5 micrometers conversely, a flat part will increase, the field which carries out metallic contact at the time of press working of sheet metal increases, coefficient of friction increases between dices, and it becomes easy to generate a crack between a steel plate and a dice.

[0008] Drawing 2 is the typical sectional view showing the condition of performing temper rolling with the roll by which dull processing was carried out. Using the work roll which performed dull processing with laser etc., by rolling out the rate of the lightly pressurizing in a temper rolling process to a steel plate, for example, cold rolled sheet steel [finishing / annealing], the dull eye of a roll is imprinted by the steel plate front face, and a split face is formed in a steel plate front face. If the steel plate front face in this process is observed microscopically, as shown in drawing 2, almost uniform height will be forced on a flange 5 by the pressure strong against the front face of a steel plate 1 in the front face of a roll 4, a local presentation flow of an ingredient will arise near the front face of the sheet steel

[elasticity / quality of the material / of a roll 4 / by this] 1, the metal of a steel plate 1 will flow into the inside of the crater 6 of a roll 4, and a split face will be formed. the middle flatness 9 which the top face 8 of Yamabe of the trapezoidal shape which rose in the inside of a crater 6 at this time turns into a flat side with the steel plate front face of a basis, and is forced on the flat side 7 of flange 5 outside between the adjacent craters 6 in a roll 4 -- as it is -- a flat side -- becoming -- and the flat top face 8 -- the middle flat part 9 -- mist -- it is high or is set to the same level.

[0009] It is in on the other hand having prepared the random irregularity whose average-of-roughness-height Ra is 0.6-1.1 micrometers in the field of another side. It is an element with the surface roughness of a steel plate most important for press-forming nature, and surface roughness is required also in order to control generating of die galling by controlling a contact condition with a press die. Therefore,

average-of-roughness-height Ra becomes easy to generate printing in less than 0.6 micrometers at the time of press working of sheet metal. Moreover, if it exceeds 1.1 micrometers, the image clarity after paint will not become good enough, but by preparing the random irregularity in within the limits of 0.6-1.1 micrometers, the improvement effectiveness in a sump ball by random roughness grant is planned, and Ra can improve press-forming nature.

[0010] Drawing 3 is drawing showing the microscopic gestalt by the microphotography of a cold rolling plate front face. As shown in drawing 3, it turns out that the array whose crevice pitch showed the fixed location very regularly to the diameter list of a hole and a crevice is shown. Drawing 4 is drawing showing the microscopic gestalt by the microphotography on the rear face of a cold rolling plate. As shown in drawing 4, random concave convex voice is shown. With this random roughness, improvement in a sump ball is achieved and the good plate of press-forming nature is obtained.

[0011] Drawing 5 is drawing showing the cylinder deep-drawing shaping trial of the cold rolled sheet steel of this invention. As an evaluation test of the inner plate for automobiles, the existence (a press and workability) of a crack was investigated after processing, and the marginal contraction ratio (L, D, R) estimated. This L, D, and R ask for the diameter of the maximum blank which can carry out deep drawing using the metal mold of diameter D of punch 32mm, and ask for it from the ratio of that diameter of the maximum blank and diameter of punch. consequently, drawing 6 the steel plate of this invention indicates a press workability evaluation result to be -- L, D, and R 2.35 of the conventional material -- it is -- it receives, and L of this invention material, D, and an R value are as high as 2.45, and deep drawability and die-galling-proof nature are excellent. In addition, although the above has been explained centering on a steel plate, it is possible for it not to be limited to a steel plate and to apply also to an aluminum plate at a hot-dip zinc-coated carbon steel sheet, an electroplating steel plate, and a stainless steel plate list.

SS
[0012]

[Effect of the Invention] As stated above, while manufacture of the cold rolling plate which combines press nature and the high image clarity after paint was attained as compared with the conventional steel plate, the press workability of the steel plate for automobiles which was not made conventionally is good, and it enabled quality problems, such as a crack, to solve completely.

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1] The explanatory view showing the profile which forms the split face of the front face of the steel plate concerning this invention,

[Drawing 2] The typical sectional view showing the condition of performing temper rolling with the roll by which dull processing was carried out,

[Drawing 3] Drawing showing the microscopic gestalt by the microphotography of a cold rolling plate front face,

[Drawing 4] Drawing showing the microscopic gestalt by the microphotography on the rear face of a cold rolling plate,

[Drawing 5] Drawing showing the cylinder deep-drawing shaping trial of the cold rolled sheet steel of this invention,

[Drawing 6] It is drawing showing a press workability evaluation result.

[Description of Notations]

- 1 Steel Plate
- 2 Surface Trough
- 3 Middle Flat Part
- 4 Roll
- 5 Flange
- 6 Crater
- 7 Flat Side
- 8 Flat Top Face
- 9 Middle Flat Part

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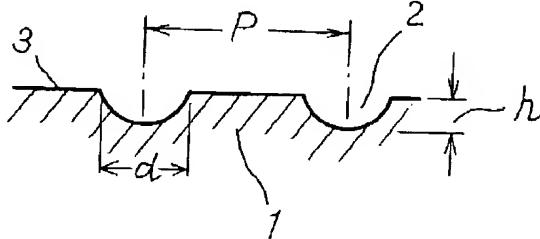
(54)【発明の名称】 冷間圧延板

(57)【要約】

【目的】 鮮映性の補強とプレス加工性の改善とを両立的に実現するためのもので、鮮映性およびプレス加工性の改善に関して有利に解決を図ること。

【構成】 上下1組の圧延用ワーカロールに異なる粗度を付与し、調質圧延することによって鋼板表裏面にそれぞれ異なる粗度を設けた冷延板において、一方の面には直径dが50~200μm、凹部深さhが2~16μm、隣接する凹部中心間距離Pが0.5~2.5μmの規則的な凹凸を設け、他方の面には平均粗さRaが0.6~1.1μmのランダムな凹凸を設けた冷間圧延板。

【効果】 従来の鋼板に比較し、プレス性と塗装後の高鮮映性を兼ね備えた冷間圧延板の製造が可能になると共に、従来出来なかった自動車用鋼板のプレス加工性が良く、ひび割れ等の品質問題が完全に解決された。



【特許請求の範囲】

【請求項1】 上下1組の圧延用ワーカロールに異なる粗度を付与し、調質圧延することによって鋼板表裏面にそれぞれ異なる粗度を設けた冷延板において、一方の面には直径dが50～200μm、凹部深さhが2～16μm、隣接する凹部中心間距離Pが0.5～2.5μmの規則的な凹凸を設け、他方の面には平均粗さRaが0.6～1.1μmのランダムな凹凸を設けたことを特徴とする冷間圧延板。

【発明の詳細な説明】

【0001】

【産業上の利用分野】 本発明は外面に塗装後の鮮映性を他面にプレス加工性を有する両面性能の異なる冷間圧延板に関するものである。

【0002】

【従来の技術】 従来、加工用冷間圧延鋼板はプレス加工し易くするため、鋼板表面をダル仕上げする。すなわち、プレス加工時鋼板表面に形成された凹凸に加工用潤滑油が貯留され、金型と鋼板の摩耗を少なくし、かつ焼付けを防止する作用をするからである。また、プレス成型性に関する研究は、素材である鉄板側と成型技術の両面から行われているが、製品の高精度化と複雑化に伴い鋼板に対する要求特性がより高級化、多様化しつつある。このため現状としては、鋼板粗度を最終的に調整する調質圧延において、ショットブラスト、放電あるいはレーザー等でダル加工したワーカロールを使用し、鋼板表面に粗さを転写している。

【0003】 また、自動車ボディや家電製品などの外装鋼板は塗装仕上げをして美観を付与するが、この際塗装面の乱反射によって美観を損なわないようにするという、いわゆる鮮映性に優れていることが要求される。そこで、例えば鋼板の表面粗度プロファイルを改良して、塗装後の塗装表面凹凸を少なくし水平部分の占める割合を多くすることによって、光の正反射率の向上と写像の歪みを少なくして、塗装後の鮮映性を従来よりも向上させ得る鋼板として、特公平3-38923号公報が知られている。また、特公平3-39761号公報のように、鮮映性を従来よりも格段の向上させ得る塗装用鋼板であるが、中心線表面粗さRaが大きいほど、山と谷の振幅が大きくなり、そのため塗装面の凹凸が激しくなり、光の乱反射を生じて光沢性を損なうとともに、写像の歪みを招いて写像性の低下を招き、鮮映性を劣化させることになる。

【0004】

【発明が解決しようとする課題】 上述したように、塗装後の塗装表面凹凸を少なくし水平部分の占める割合を多くすることによって、光の正反射率の向上と写像の歪みを少なくし、塗装後の鮮映性を向上させる反面、プレス加工性が悪くなる。また、一方プレス加工性を高めるために中心線表面粗さRaを大きくすると山と谷の振幅が

大きくなり、そのため塗装面の凹凸が激しくなり、光の乱反射を生じて光沢を損なうと共に、写像の歪みを招いて写像性の低下を招き、鮮映性を劣化するという両面相反することになる。従って本発明は鮮映性の増強とプレス加工性の改善とを両立的に実現しようとするもので、鮮映性およびプレス加工性の改善に関して有利な解決を図ることが、この発明の目的である。

【0005】

【課題を解決するための手段】 本発明は上述のような問題を解消し片面は鮮映性の増強と他面はプレス加工性の改善を図り、鮮映性およびプレス加工性の両者優れた冷間圧延板にある。その発明の要旨とするとところは、上下1組の圧延用ワーカロールに異なる粗度を付与し、調質圧延することによって鋼板表裏面にそれぞれ異なる粗度を設けた冷延板において、一方の面には直径dが50～200μm、凹部深さhが2～16μm、隣接する凹部中心間距離Pが0.5～2.5μmの規則的な凹凸を設け、他方の面には平均粗さRaが0.6～1.1μmのランダムな凹凸を設けたことを特徴とする冷間圧延板にある。

【0006】

【作用】 以下本発明について図面に従って詳細に説明する。図1は本発明に係る鋼板の表面の粗面を形成するプロファイルを示す説明図である。図1に示すように、鋼板1の表面の谷部2の外縁の平均直径dが50～200μm、中間平坦部3からの凹部深さhが2～16μm、隣接する凹部中心間距離Pが0.5～2.5μmの規則的な凹凸を設けたことの条件範囲について述べる。先ず直径dは50μm未満の場合は鋼板凸部表面への潤滑油供給不十分による金属接触部分が発生し、プレス加工性が悪く、疵等が発生し易くなる。また、200μmを超えるとプレス加工性は良いが塗装後の表面において凹凸が消えないために鮮映性が低下する。

【0007】 次に中間平坦部からの凹部深さhを2～16μmとした理由は、凹部深さ2μm未満では成形中の面圧により凹部が潰されて潤滑剤を確保できず、摩擦抵抗が増大するためであり、16μmを超えると表面に凹凸が消えないために鮮映性が低下する。更に隣接する凹部中心間距離Pが0.5～2.5μmの規則的な凹凸を設けた理由は0.5μm未満であると、凹部の重なりにより突起が生じ、プレス加工中に突起部が取れ、鉄粉の発生が多くなり、プレス加工性を損ねるからであり、逆に2.5μmを超えると平坦部が多くなり、プレス加工時に金属接触する面が多くなり、ダイス間において摩擦係数が増大して鋼板とダイス間で疵が発生し易くなる。

【0008】 図2はダル加工されたロールにより調質圧延を施す状態を示す模式的な断面図である。レーザ等によりダル加工を施したワーカロールを用い、調質圧延工程において鋼板、例えば焼鉄済みの冷延鋼板に軽圧下率の圧延を施すことによって、ロールのダル目が鋼板表面

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に転写され、鋼板表面に粗面が形成される。この過程における鋼板表面を微視的に観察すれば、図2に示すようにロール4の表面ではほぼ均一な高さをフランジ5が鋼板1の表面に強い圧力で押し付けられ、これによりロール4の材質より軟質な薄鋼板1の表面近傍で材料の局所的組成流動が生じて、ロール4のクレータ6の内側へ鋼板1の金属が流れ込んで粗面が形成される。このときクレータ6の内側において盛り上がった台形状の山部の頂面8はもとの鋼板表面のまま平坦面となり、またロール4における隣り合うクレータ6間のフランジ5外側の平坦面7に押し付ける中間平坦部9はそのまま平坦面となり、かつ平坦頂面8は中間平坦部9よりもやや高いか又は同じレベルとなる。

【0009】一方、他方の面には平均粗さ R_a が $0.6 \sim 1.1 \mu\text{m}$ のランダムな凹凸を設けたことにある。鋼板の表面粗度は、プレス成形性にとって最も重要な要素であり、プレス型との接触状態を制御することによって型かじりの発生を抑制するために表面粗度は必要である。従って、平均粗さ R_a が $0.6 \mu\text{m}$ 未満ではプレス加工時において焼付けが発生し易くなる。また、 $1.1 \mu\text{m}$ 超えると塗装後の鮮映性が充分に良好とならず、 R_a は $0.6 \sim 1.1 \mu\text{m}$ の範囲内のランダムな凹凸を設けることにより、ランダムな粗度付与による油溜まり向上効果が図られ、プレス成形性を改善することが出来る。

【0010】図3は冷間圧延板表面の顕微鏡写真による微視的形態を示す図である。図3に示すように、極めて規則的に穴及び凹部の直径並びに凹部中心間距離が一定位置を示した配列が示されていることがわかる。図4は冷間圧延板裏面の顕微鏡写真による微視的形態を示す図である。図4に示すように、ランダムな凹凸状態を示している。このランダムな粗度によって油溜まりの向上が図られ、プレス成形性の良好な板が得られる。

【0011】図5は本発明の冷延鋼板の円筒深絞り成形試験を示す図である。自動車用内板の評価テストとして、加工後にひび割れの有無（プレス・加工性）を調査し、かつ限界絞り比（L, D, R）にて評価した。このL, D, Rはポンチ径D 32 mm の金型を用いて深絞り

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しうる最大素板径を求め、その最大素板径とポンチ径との比から求めたものである。その結果、本発明の鋼板は、プレス加工性評価結果を示す図6より、従来材のL, D, Rが2.35であるに対して本発明材のL, D, R値は2.45と高く、深絞り性および耐型かじり性が優れている。なお、以上は鋼板を中心に説明してきたが、鋼板に限定されるものでなく、溶融亜鉛めっき鋼板、電気めっき鋼板及びステンレス鋼板並びにアルミニウム板にも適用することが可能である。

10 【0012】

【発明の効果】以上述べたように、従来の鋼板に比較し、プレス性と塗装後の高鮮映性を兼ね備えた冷間圧延板の製造が可能になると共に、従来出来なかった自動車用鋼板のプレス加工性が良く、ひび割れ等の品質問題が完全に解決することが可能となった。

【図面の簡単な説明】

【図1】本発明に係る鋼板の表面の粗面を形成するプロファイルを示す説明図、

【図2】ダル加工されたロールにより調質圧延を施す状態を示す模式的な断面図、

【図3】冷間圧延板表面の顕微鏡写真による微視的形態を示す図、

【図4】冷間圧延板裏面の顕微鏡写真による微視的形態を示す図、

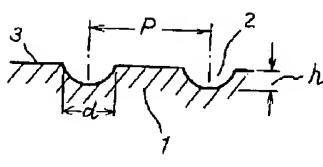
【図5】本発明の冷延鋼板の円筒深絞り成形試験を示す図、

【図6】プレス加工性評価結果を示す図である。

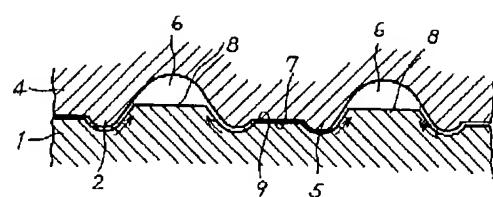
【符号の説明】

30 1 鋼板
2 表面の谷部
3 中間平坦部
4 ロール
5 フランジ
6 クレータ
7 平坦面
8 平坦頂面
9 中間平坦部

【図1】



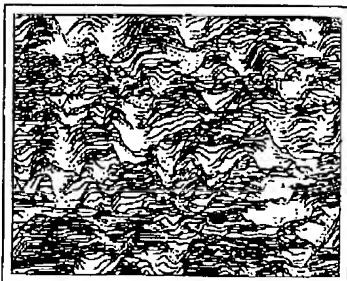
【図2】



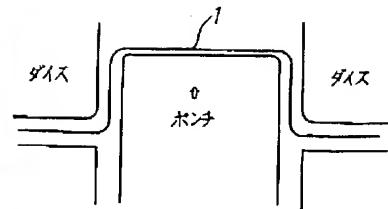
【図3】



【図4】



【図5】



【図6】

